AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraphs beginning at page 1, line 19, as follows:

Electrically tunable resonators are attractive components for agile radar and mobile radio communication systems. Different types of resonators are known. Dielectric and parallel plate resonator and filters for microwave frequencies using dielectric disks of any shape, for example circular, are known ~~e.g.~~ for example, from Vendik et al., Electronics Letters vol. 31, p. 654, 1995, which herewith is incorporated herein by reference.

Please amend the paragraphs beginning at page 2, line 4, as follows:

Dielectric, parallel plate resonators can be excited by simple probes or loops. For the majority of practical implementations the thickness of a parallell plate resonator is much smaller than the wavelength of the microwave signal in the resonator in order for the resonator to support only the lowest order TM modes and in order to keep the DC-voltages, which are required for the electrical tuning of the resonator comprising a dielectric substrate with electrodes arranged on both sides of it, as low as possible. For such resonators electrical tuning is obtained by means of the application of an external DC-biasing voltage, which is supplied by means of ohmic contacts to the electrodes acting as plates of the resonator. Tunable resonators based on thin film substrates as well as resonators based on dielectric bulk substrates are known. A resonator is considered to be electrically thin if the thickness is smaller than half the wavelength of the microwave signal in the resonator such that no standing waves will be present along the axis of the disk. Electrically tunable resonators based on circular ferroelectric disks have recently been found attractive and have drawn much attention, for example, for applications as tunable filters in microwave communication systems, as well as in mobile radio communication systems.

Please amend the paragraph beginning at page 2, line 26, as follows:

Such devices are for example described in "Tunable Microwave Devices", which is a Swedish patent application with application number 9502137-4 and corresponding US Patent 6,463,308; and, "Arrangement and method relating to tunable devices" which is a Swedish patent application with application number 9502138-2 and corresponding US Patent 6,187,717 which herewith are incorporated herein by reference.

Please amend the paragraph beginning at page 3, line 1, as follows:

Substrates comprising ferroelectric materials in resonators and filters are of interest for different reasons. Among other things ferroelectric materials are able to handle high peak power, they have a low switching time, and the dielectric constant of the substrate varies with an applied biasing voltage, which makes the impedance of the device vary with an applied biasing electric field. For example US-~~A~~-5 908 811, "High Tc Superconducting Ferroelectric Tunable Filters", shows an example of such a filter which should get low losses by means of using a single crystal ferroelectric material. A ferroelectric thin film substrate is used. However, this device as well as other resonators and filters based on ferroelectric materials suffer from the drawback of the quality factor (Q-value) of the ferroelectric substrate or element decreasing drastically with the applied voltage, when a biasing voltage is applied. This has recently been established by A. Tagantsev in "DC-Electric-Field-induced microwave loss in ferroelectrics and intrinsic limitation for the quality factor of a tunable component", Applied Physics Letters, Vol. 76, No. 9, February 28, 2000, p. 1182-84, to be a consequence of a fundamental loss mechanism (called quasi-Debye Effect) induced in the ferroelectric material by the applied biasing field. However, so far, no satisfactory solution to the problem associated with induced losses in tunable ferroelectric resonators has been found.

Please amend the paragraph on page 5, line 27, as follows:

The substrate of the second resonator may for example comprise $SrTiO_3$, $KTaO_3$, or $BaSTO_3$ ~~or any other material with similar properties~~.

Please amend the paragraph on page 10, line 33, as follows:

Figs. 13A, 13B illustrate simulated results of the insertion losses and the return losses as functions of the frequency for different values of the biasing voltage for a tunable two-pole filter as in Fig. 11.

Please amend the paragraph on page 11, line 17, as follows:

Parallel plate resonators, for example in the form of circular dielectric disks and circular patches on dielectric substrates, have found several different microwave applications. The resonators are seen as electrically thin if the thickness (d) is smaller than half the wavelength of the microwave (λ_g) in the resonator, $d<\lambda_g/2$, so that no standing waves will be present along the axis of the disk. Electrically tunable resonators based on circular ferroelectric disks have been largely investigated for applications in tunable filters. A simplified electrodynamic analysis of a parallel plate resonator proposes a simple formula for the resonant frequency:

$$f_{nm0} = \frac{c_o k_{nm}}{2\pi r\sqrt{\varepsilon}}$$

where c_0~~=3.10~~3x10^8m/s is the velocity of light in vacuum, ε is the relative dielectric constant of the disk/substrate, r is the radius of the conducting plate, and k_{nm} are the roots of Bessel functions with mode indexes n and m. For an electrically thin parallel-plate resonator the third index is 0. The above formula may be corrected taking fringing fields into account.

Please amend the paragraph beginning at page 12, line 14, as follows:

In a particularly advantageous implementation of the present invention, the mode selected for the resonators is the TM_{020} mode. The invention is however not limited to any particular mode but substantially any mode could be selected. Mode selection is among others discussed in "Microwave Device and Method Relating Thereto" with U.S. Application No. ~~9901190-0~~ 09/539,797 as discussed earlier in the application.

Please amend the paragraph beginning at page 12, line 21, as follows:

Fig. 2 schematically illustrates an electronically tunable resonator 10_0 based on a non-linear dielectric substrate 3_0 with an extremely high dielectric constant, e.g. STO ($SrTiO_3$) which has a dielectric constant of more than 2000 at the temperature of liquid nitrogen (N) and a dielectric constant of about 300 at room temperature. On both sides of the substrate high temperature superconductors 1_{01}, 1_{02}, e.g. of YBCO, are respectively provided which in turn, in this embodiment, are covered by thin non-superconducting, high conductivity films 2_{01}, 2_{02} of e.g. Au. As an example the resonant frequencies of a circular parallel plate disk resonator having a diameter of 10 mm and a thickness of 0.5 mm will be in the range of 0.2-2.0 GHz depending on the temperature and on the applied DC biasing. Such resonators can be excited by simple probes or loops as in/out coupling means. In most practical cases the thickness of a parallel plate resonator is much smaller than the wavelength of the microwave signal in order for the resonator to support only the lowest order TM-modes, and in order to keep the DC-voltages, which are required for the electrical tuning of the resonator with a non-linear dielectric substrate as low as possible. ~~This is discussed in Gevorgian et al., "Low order modes of YBCO/STO/YBCO circular disk resonators", IEEE Trans. Microwave Theory and Techniques vol. 44, No. 10, Oct. 1996 which herewith is incorporated herein by reference.~~ The field distribution of such a resonator was shown in Fig. 1A above, for the TM_{010} mode, and in Fig. 1D for the TM_{020} mode, respectively.

Please amend the paragraph beginning on page 12, line 23, and continuing to page 13, line 13, as follows:

Fig. 2 schematically illustrates an electronically tunable resonator 10_0 based on a non-linear dielectric substrate 3_0 with an extremely high dielectric constant, e.g. STO ($SrTiO_3$) which has a dielectric constant of more than 2000 at the temperature of liquid nitrogen (N) and a dielectric constant of about 300 at room temperature. On both sides of the substrate high temperature superconductors 1_{01}, 1_{02}, e.g. of YBCO, are provided which in turn, in this embodiment, are covered by thin non-superconducting, high conductivity films 2_{01}, 2_{02} of e.g. Au. As an example the resonant frequencies of a circular parallell plate disk resonator having a diameter of 10 mm and a thickness of 0.5 mm will be in the range of 0.2-2.0 GHz depending on the temperature and on the applied DC biasing. Such resonators can be excited by simple probes or loops as in/out coupling means. In most practical cases the thickness of a parallell plate resonator is much smaller than the wavelength of the microwave signal in order for the resonator to support only the lowest order TM-modes, and in order to keep the DC-voltages, which are required for the electrical tuning of the resonator with a non-linear dielectric substrate as low as possible. This is discussed in Gevorgian et al., "Low order modes of YBCO/STO/YBCO circular disk resonators", IEEE Trans. Microwave Theory and Techniques vol. 44, No. 10, Oct. 1996~~ which herewith is incorporated herein by reference~~. The field distribution of such a resonator was shown in Fig. 1A above, for the TM_{010} mode, and in Fig. 1D for the TM_{020} mode.

Please amend the paragraph beginning on page 14, line 5, as follows:

Thus, in Fig. 4, a first embodiment of the present invention is illustrated. It shows a resonator arrangement 10 comprising a resonator apparatus with a first resonator 1 and a second resonator 2~~, which r~~Resonators 1 and 2 are coupled to each other. The first resonator comprises a circular disk resonator with a first electrode plate 12, and a linear

substrate 11 with a high quality factor (Q) which is not tunable. The substrate material may for example comprise sapphire, $LaAlO_3$ or any of the other materials referred to earlier in the application. The first resonator 1 comprises another electrode plate 13 disposed on the other side of the linear substrate. The electrodes 12, 13 may comprise a "normally" conducting (i.e. non-superconducting, but preferably high conductivity) metal, such as for example Au, Ag, Cu but they may also comprise a superconducting material. In a particularly advantageous implementation the electrode plates 12, 13 comprise a high temperature superconducting material, e.g. YBCO.

Please amend the paragraphs beginning at page 15, line 1 through line 34, as follows:

Thus the common electrode 13 forms a common ground plane for the first and second resonators 1,2. The first and second resonators 1,2 are coupled to each other through coupling means 5, here comprising a slot or an aperture in the common ground plane 13 allowing for distributing of electromagnetic energy between the two resonators upon application of a biasing voltage (V_B). For application of the biasing voltage, biasing means 3 are provided comprising a variable voltage source which is connected to the ground plane 13 and to the first electrode 21 of the second resonator 2, such that for tuning of the resonator apparatus, the biasing voltage is applied to the second resonator 2. When the biasing voltage V_B is applied and increased, the resonant frequency of the second resonator 2 will increase. Electromagnetic energy will then be relocated to the first resonator 1, which means that the increased loss tangent of the second resonator, which, as discussed above, increases as the biasing voltage is increased, will have a low influence on the resonator apparatus as such. Thus, as the biasing voltage increases, more and more electromagnetic energy will be transferred or redistributed to the first resonator 1. In this manner the increased loss in the tunable second resonator 2 will be compensated ~~for~~.

Please amend the paragraph beginning at page 16, line 1, as follows:

In the figure input coupling means 4 in the form of an antenna are shown for input of microwave signals to the microwave device for exciting the relevant mode or modes. In principle any input/output coupling means can be used and the antenna is merely indicated for indication of an example ~~on~~ of input coupling means. Different types of input/output coupling means are discussed in the Swedish patent application "Arrangement and Method Relating to Microwave Devices" filed on April 18, 1997 with the application No. 9701450-0 and corresponding US Patent 6,185,441 and the content of which herewith are incorporated herein by reference. In this document it is among other illustrated how the coupling means can be used for application of a biasing voltage. It also illustrates examples on coupling means that can be used while still requiring separate biasing means, as well as a number of state of the art devices. The present invention is not limited to any particular way of coupling microwave energy into/out of the device, the main thing being that the biasing voltage is applied to the second resonator, which is tunable, and which is coupled to another resonator which is not tunable, which resonators are coupled to one another such that redistribution of electromagnetic energy is enabled.

Please amend the paragraph beginning at page 17, line 1, as follows:

In Fig. 5 the equivalent circuit of the two coupled resonators 1,2 of Fig. 4 is illustrated. Z_{in} represents the input impedance of the arrangement R_1, C_1 represent the ~~resistance~~ reactance and the capacitor of the first, non-tunable resonator 1. R_2, C_2 represent the tunable components of the second resonator 2, and C_0 5 is the coupling capacitor coupling the first and second resonators to each other.

Please amend the paragraph beginning at page 18, line 11, as follows:

Figs. 7A illustrate the real and imaginary parts of the input impedance at zero applied voltage. Correspondingly Figs. 7B, 7C illustrates the real and imaginary parts of the impedance at a biasing voltage of 100V and 200V respectively. As understood by

those skilled in the art, the real part is always positive, whereas the imaginary part is positive as well as negative. As can be seen from Figs. 7A – 7C, for zero biasing voltage (Fig. 7A) the resonant frequency will be about 2459.4 MHz, for a biasing voltage of 100V (Fig. 7B)it will be 2509.3 MHz and for an applied biasing voltage of 200V(Fig. 7C) it will be about 2530.9 MHz. The frequency shift ΔF will be 49.9 MHz for 100V and 71.5 MHz for 200 V biasing voltage. In the given range of the applied voltage, the loss factor of the ferroelectric, tunable substrate material will change about 30 times. However, the total quality factor change will be no more than about ±30%. If the frequency band of the resonator is about 0.5 MHz, the resonator figure of merit will be $\Delta F/\Delta f \approx 71.5/0.5 \approx 140$. It should however be clear that Figs. 6A,6B,7A,7B,7C merely are included for illustrative and exemplifying purposes.

Please amend the paragraph beginning at page 19, line 26, as follows:

Figs. 9A, 9B in a manner similar to that of Figs. 8A, 8B illustrate a first resonator 1B (Fig. 9A) and a second resonator 2B (Fig. 9B) together forming an alternative resonator apparatus in which the first and second resonators 1B, 2B are square-shaped. The first resonator 1B, like in the preceding embodiment, comprises a linear material with a high quality factor which is non-tunable, e.g. of $LaAlO_3$, and the second resonator 2B comprises a tunable ferroelectric material e.g. of STO. The first resonator 1B comprises a first electrode plate 12B which of course can be similar to the electrode plate of Fig. 8A with the difference that it is square-shaped, but it may also, as illustrated in the figure, comprise a very thin, (thin in order not to affect the surface impedance) superconducting layer $12B_1$ covered, on the side opposite to the substrate, by a non-superconducting high conductivity film $12B_2$ e.g. of Au, Ag, Cu or similar for protective purposes. Particularly the superconducting film is high temperature superconducting, e.g. of YBCO.

Please amend the paragraph beginning at page 20, line 31, as follows:

The inventive concept is also applicable to dual mode operating resonators, oscillators, filters whereby dual mode operation can be provided for in different manners, e.g. as disclosed in the patent application "Tunable Microwave Devices" and US Patent US Patent 6,463,308 which was incorporated herein by reference.

Please amend the paragraph beginning on page 21, line 14, and continuing to page 21, line 30, as follows:

In one implementation the inventive concept is extended to a tunable filter 100~~, of~~ (refer to. Fig. 11). It is supposed that two resonator apparatuses 10D, 10E are provided each comprising a first resonator 1D, 1E respectively and a second resonator 2D, 2E respectively, which share a common ground plane 13F. In this embodiment the first resonators 1D,1E comprise a common substrate 11C. There may alternatively be separate substrates. The distance between the resonator apparatuses gives the coupling strength of the filter. ~~It may e.g. be supposed that t~~The resonator apparatuses can comprise circular disk resonators as described in for example Figs. 4-8 or any other alternative kind of resonators, the main thing being that two resonator apparatuses as discussed herein are used to provide a tunable two-pole filter. Coupling between the resonators of each resonator apparatus is provided by coupling means 5D, 5E. By using tunable disk resonators, the power handling capability will be higher than if thin film resonators are

Please amend the paragraph beginning at page 21, line 31, through page 22, line 18, as follows:

Fig. 12 illustrates the equivalent circuit of a two-pole filter 100 as in Fig. 11 which is connected by a transmission line section. In the figure it is illustrated the first resonator apparatus 10D with ~~resistance~~ reactance R_{1D} and capacitance C_{1D} corresponding to the first non-tunable resonator 1D and the tunable resonator 2D comprising a reactance~~resistance~~ R_{2D} and capacitance C_{2D} which resonators are coupled to each other by the coupling means 5D represented by a capacitor C_{04}. The inductances L_{04}, L_{004}; L_{05}, L_{005} of the resonators are also illustrated in the figure as explained earlier with reference to Fig. 6A, 6B, 7A, 7B. To the first resonator apparatus is connected a second resonator apparatus 10E comprising a first resonator 1E and second resonator 2E with the respective non-tunable and tunable components resistance R_{1E}, C_{1E} and R_{2E}, C_{2E} respectively and connecting capacitor C_{05} corresponding to coupling means 5E. It is supposed that the two-pole filter is connected by a transmission line section. In the exemplifying figure the characteristic impedance of the external line $Z_0 = 50$ Ohm, the characteristic impedance of the coupling line $Z_{01} = 45$ Ohm, and the electrical length of the coupling line at the central frequency is 80°.